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Exploring the mediating effect of coping strategies on adjustment after sustaining a spinal cord injury within the Norwegian context

Master's thesis in Physical Activity and Health

Supervisor: Annelie Schedin Leiulfsrud

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Norwegian University of Science and Technology
Faculty of Medicine and Health Sciences
Department of Neuromedicine and Movement Science



Abstract

Purpose: This study aimed: 1) to examine the relationship between functional independence and level of adjustment post-spinal cord injury. 2) to examine potential gender differences in levels of adjustment and 3) to examine the mediating effect of self-efficacy and active coping strategies on the relationship between functional independence and level of adjustment as suggested by the Spinal Cord Injury Adjustment Model (SCIAM).

Method: The study design was a cross-sectional community survey using data from the Norwegian part of the International SCI Community Survey. In contrast to previous studies this study aimed at using a comprehensive adjustment variable. Statistical analyses used were 1. Spearman correlations 2. Independent t-test and 3. A measure of mediation analysis.

Result: Of the 610 participants who responded, 68,5% were male with a mean age of 56,9. Functional independence was positively correlated ($r = 0,436$) with adjustment. The difference in adjustment levels between males and females was 2,90 out of 100 (95% CI: 0,19 to 5,61). Psychological resources fully mediated the effect of functional independence on adjustment. There was statistically significant double mediation first through self-efficacy, then through active coping strategies ($\beta=0,02$; 95% CI 0,01 to 0,03). The pathway from functional independence through active coping strategies to adjustment showed the largest mediation proportion of 0,49.

Conclusion: There is a positive correlation between functional independence and adjustment. Females had a slightly lower level of adjustment than males. Furthermore, self-efficacy and active coping strategies are mediating factors in the relationship between functional independence and adjustment and should be included in the intervention. SCIAM does explain some of the pathways in the adjustment process and may be useful in clinical and research settings. The results are mostly comparable with previous research on this subject.

Acknowledgments

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On a personal note, I would like to thank my husband, Etienne Purcell for his continued support throughout the project.

Infographic

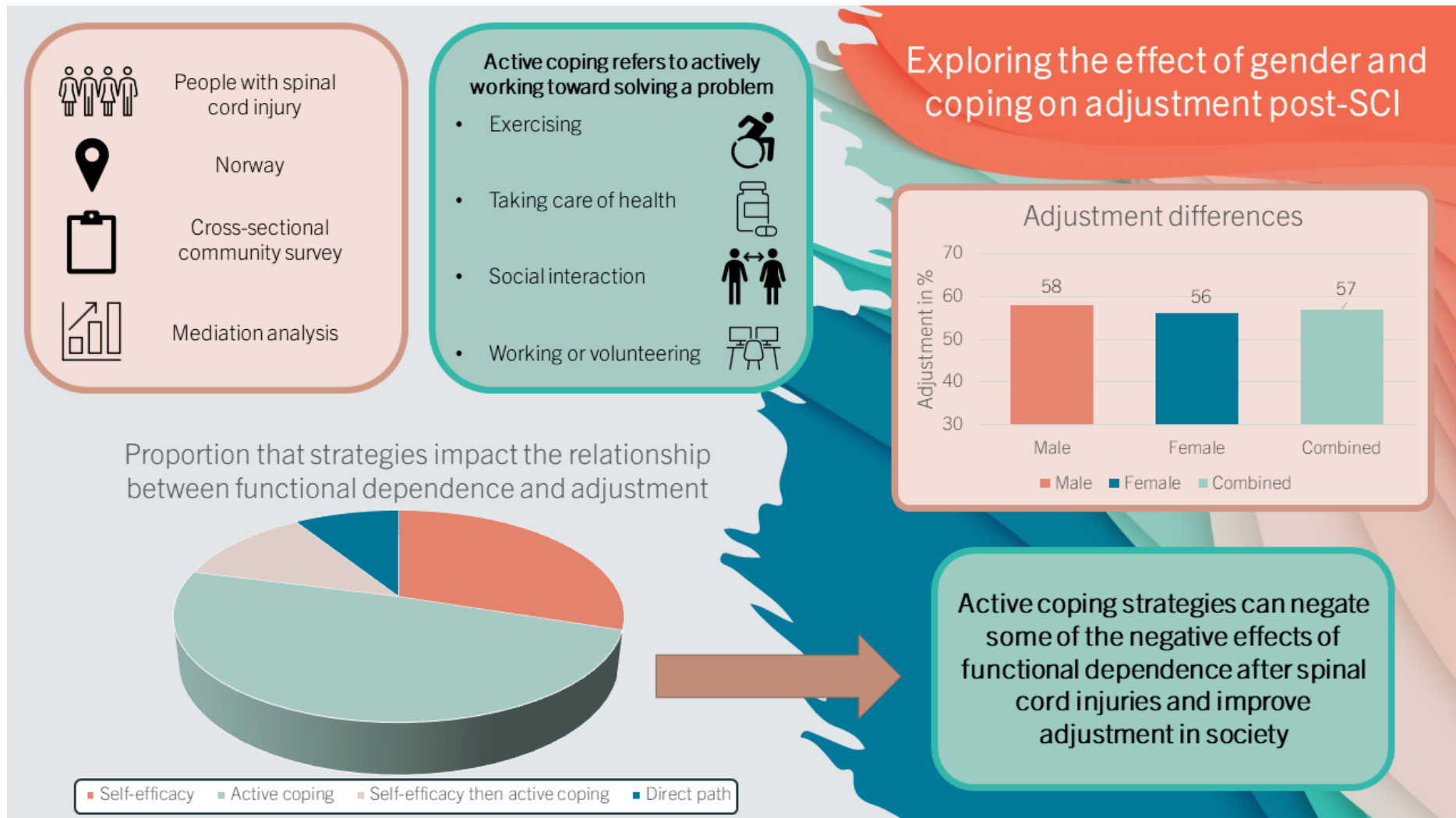


Table of contents

Contents

Abstract	i
Acknowledgments	ii
Infographic.....	iii
Table of contents	iv
List of Figures	vi
List of Tables	vi
1. Introduction	1
1.1 Functional independence	1
1.2 Psychological resources	1
1.2.1 Coping strategies as a psychological resource.....	2
1.2.2 Self-efficacy as a psychological resource.....	2
1.5 Adjustment.....	2
1.6 Novelty of the study.....	3
1.7 Research questions	3
First research question	3
Second research question	3
Third research question	3
2. Theoretical perspective	4
2.1 Relevant theories on adjustment	4
2.2 Spinal Cord Injury Adjustment Model (SCIAM)	5
2.2.1 History of the SCIAM.....	5
2.2.2 The dynamics of the SCIAM.....	6
2.2.3 Research on SCIAM.....	7
2.2.4 Strengths and limitations of using SCIAM.....	7
3. Methodology.....	8
3.1 Study design.....	8
3.2 Participants.....	8

3.3 Measurement	8
3.4 Data preparation	9
3.5 Variables	10
3.5.1 Confounding factors	10
3.5.2 Functional independence.....	10
3.5.3 Mediation variables	10
3.5.4 Adjustment	10
3.6 Analyses.....	11
3.7 Ethical considerations.....	13
4. Results	14
4.1 Participants.....	14
4.2 Variables	15
4.3 Research objective one: correlation	15
4.4 Research objective two: gender differences	15
4.5 Research objective three: mediation analysis	15
5. Discussion	18
5.1 Research objective one: correlation	18
5.2 Research objective two: gender differences	18
5.3 Research objective three: mediation	19
5.3.1 Double mediation.....	20
5.3.2 Self-efficacy as a mediator.....	20
5.3.3 Active coping strategies as a mediator.....	20
5.3.4 Impact of the level of income	21
5.4 Cultural context.....	21
5.5 Limitations and future work	22
6. Implications and Conclusion	23
References	24
Appendices.....	28
Appendix A: Tables describing the compilation of the variables.	28

List of Figures

Figure 1: Illustration of the Spinal Cord Injury Adjustment Model (SCIAM).....	5
Figure 2: Illustration of the SCIAM adjusted for mediation analysis.....	6
Figure 3: Conversion scale used for data preparation.....	9
Figure 4: Mediation model used for mediation analysis.....	12
Figure 5: Results of mediation analysis.....	16

List of Tables

Table 1: Descriptive results of demographic data.....	14
Table 2: Mean and standard deviation of the variables.....	15
Table 3: Regression coefficients of mediation analysis.....	16
Table 4: Summary of mediation results.....	17

1. Introduction

A spinal cord injury (SCI) is described as a loss of motor, sensory, and autonomic function due to damage to the spinal cord (1). This can lead to a loss of function, mobility, and independence in everyday life, otherwise known as a loss of functional independence (2). Another consequence of an SCI is secondary health conditions (SHCs) such as pain, spasms, fatigue, and urinary or bowel dysfunction (3, 4) Furthermore, living with an SCI might negatively affect mental health, quality of life (QOL), and participation in society (5, 6, 7). Therefore, it is important to investigate how to improve these negative consequences of an SCI. One way to examine the impact of an SCI on a person's life is to look at their level of adjustment after the injury (8).

This study will focus on the relationship between functional independence and adjustment after an SCI, specifically the impact of psychological resources on adjustment. In this study, adjustment refers to the process whereby a person adapts to their new reality and environment after a major injury (2, 9).

1.1 Functional independence

Decreased functional independence refers to the decrease in functional everyday activities that a person can manage on their own without the assistance of another person. These everyday activities include self-care, mobility, and domestic activities (2).

1.2 Psychological resources

Several studies have shown that compared to the general population, people with an SCI tend to have higher levels of psychological distress, depression, and anxiety (5, 7, 10, 11). Furthermore, the population with SCIs tends to have lower levels of life satisfaction, lower levels of participation in society, lower vitality, and overall lower QOL compared to the population without SCIs (5, 6, 7, 12).

However, there is evidence that improved psychological resources, such as self-efficacy, appraisals, and coping strategies can improve mental health, social participation, and QOL outcomes in the population living with SCIs (10, 12, 13, 14, 15, 16, 17, 18, 19).

Several of these studies have shown that these psychological resources can be mediators in the adjustment process (15, 16, 17, 19). Mediators refer to intervening factors that explain the relationship between two factors (20).

Previous studies that have studied the mediating effect of psychological resources on adjustment have defined adjustment with only one factor, such as depression or life satisfaction (15, 16, 17, 18, 19).

These studies did not include multiple factors as their adjustment variable. This study will focus on the mediating effect of coping strategies and self-efficacy with a comprehensive adjustment variable as the outcome.

1.2.1 Coping strategies as a psychological resource

Coping refers to the cognitive and behavioral efforts the person applies to the demands of a stressful event (21). Coping strategies can be divided into two broad categories: adaptive and maladaptive coping strategies. Previous research has argued that adaptive coping can lead to better QOL, life satisfaction, participation, and mental health outcomes (13, 22, 23, 24, 25).

Some studies have also reported that females tend to use different coping strategies than males. For instance, females are reported to use emotion-coping more often than males (22, 26). This is important as females with SCIs tend to have a higher risk of adverse psychological outcomes than males within the same population (11, 27). In the Norwegian context, the SCI registry showed that 69% of the patients were male (28). This difference between genders in the incidence of SCIs may lead to an under-representation of results focusing on gender-specific challenges in daily life or a tendency to treat gender merely as a background variable.

1.2.2 Self-efficacy as a psychological resource

Self-efficacy refers to an individual's beliefs about their capabilities to achieve a specific outcome. It refers to the idea a person has of their competencies to overcome a stressful situation (29). It is generally believed in the research literature that higher self-efficacy could lead to better adjustment outcomes (7, 12, 15, 16).

1.5 Adjustment

The goal of adjustment is to return, fully or partially, to the social roles the person fulfilled before the injury. The adjustment process or the adaptive response of a person to injury includes modification of behavior, thoughts, and social-, economic-, and political circumstances (2, 9).

Furthermore, this response happens over time and does not necessarily follow the same pattern for all people, it is a dynamic and multifaceted process (8, 9). The adjustment process leads to the adjustment outcome. The adjustment outcome in this study will refer to the measurement of how well-adjusted a person is in society at a specific point in time.

1.6 Novelty of the study

This study will use a comprehensive view of adjustment as an outcome variable, contrasting previous studies that only use one factor in their adjustment variable. A gender-specific view of adjustment will be reported to reflect potential differences in adjustment after sustaining an SCI. This study will look at the combined mediating effect of self-efficacy and coping strategies on adjustment.

The study aims to explore the relationships between the level of functional independence, self-efficacy, coping strategies, and the level of adjustment after sustaining an SCI in the Norwegian context.

1.7 Research questions

First research question

What is the relationship between functional independence and the level of adjustment in people with an SCI in Norway?

The hypothesis is that there is a positive correlation between functional independence and the level of adjustment in people with an SCI in Norway. For example, as functional independence increases, the level of adjustment will also increase.

Second research question

Is there a difference in the level of adjustment between males and females with an SCI? If there is a difference how can this be explained?

The hypothesis is that there is a difference in the level of adjustment between males and females living with an SCI, where females have a lower level of adjustment than males.

Third research question

Is the relationship between the level of functional independence and the level of adjustment double mediated by self-efficacy and coping strategies?

The hypothesis is that self-efficacy and coping strategies are mediating factors in the relationship between functional independence and the level of adjustment of a person living with an SCI.

2. Theoretical perspective

This study will use a theoretical perspective to interpret and make sense of the findings from an Occupational Science perspective. This process helps to deepen the discussion and compare the relevance of a theoretical model with the empirical findings of the study.

2.1 Relevant theories on adjustment

Multiple theoretical models can potentially be applied in a study of adjustment after an SCI. One of the most prominent Occupational Science models is the *Transactional model of stress and coping* introduced by Folkman and Lazarus (21, 30). In this model, stress is seen as a transactional relationship between the person and the environment. Highlighting the role of appraisal and coping. The person, as described by Folkman and Lazarus, appraises the stressful situation (primary appraisal), and evaluates their available resources (secondary appraisal). Based on this the person is believed to deploy appropriate coping strategies to overcome the stress of the situation. Similar to this is *the Stress Appraisal and Coping model (SAC)* discussed by Galvin and Godfrey (24).

Livneh (8) suggested a model that examines and explains *psychological adaptation in chronic illness and disability*. This model discusses the influence of biological, psychological, personality traits, sociocultural, and environmental factors on the process of appraisal and coping. Livneh (8) argues that when we consider adjustment as an outcome measure, we should look at it as if it were on a scale ranging from poor to excellent. According to Livneh, it is not as simple as deciding if the person is adjusted or not adjusted, there are many other possibilities in-between (8).

Other models outside of psychology of relevance to adjustment in SCI literature are the *International Classification of Functioning, Disability, and Health (ICF)* and the *Model of Human Occupation (MOHO)*. Both these models have an occupational science and participation focus. The *ICF* describes the barriers and facilitators towards participation but does not focus on the psychological process of adjustment (31). The author of *MOHO* suggests that occupation consists of the interaction between the human, the task, and the environment. *MOHO* pays attention to factors such as motivation, values, belief systems, daily routines, social roles, and the physical and mental capacity of a person (32).

The *Spinal Cord Injury Adjustment Model (SCIAM)* incorporates many of the factors in the above-mentioned models. It is also specifically designed to explain the adjustment process after an SCI and places a large focus on the possible mediating effects of coping strategies (9). This model was chosen as the theoretical perspective for this study.

2.2 Spinal Cord Injury Adjustment Model (SCIAM)

SCIAM was first introduced by Craig and colleagues (9). The researchers defined adjustment to SCIs as “a complex process, multi-factorial in nature involving non-linear adaptation over time” (9).

The SCIAM is based on an idea of dynamic relationships between the predisposing factors (biological, psychological, social, environmental), mediators (appraisals, coping strategies), and adjustment (9).

According to this model, the adjustment outcome can be improved by improving predisposing factors like the social environment, or by addressing the appraisal and coping strategies of the person. Figure 1 depicts the dynamic relationship between the different factors as described by SCIAM.

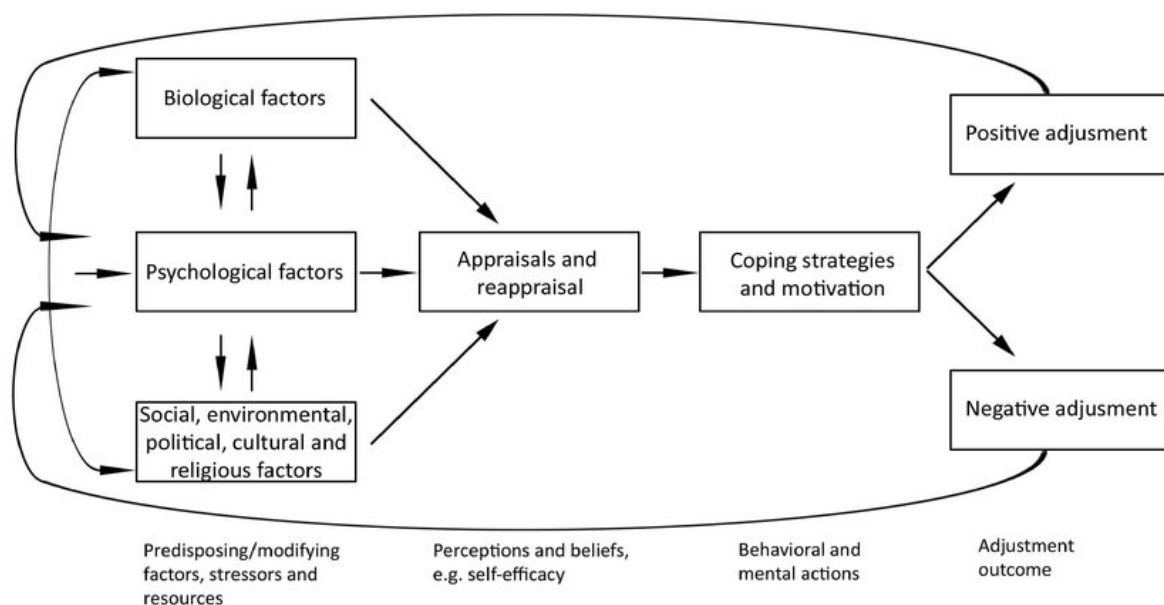


Figure 1: illustration of the Spinal Cord Injury Adjustment Model described by Craig and Tran (9). It shows the pathways and interactions between modifying factors and mediating factors such as coping and adjustment outcomes.

2.2.1 History of the SCIAM

Theoretical elements and insights incorporated into the SCIAM are the Transactional Model of Stress and Coping, the Stress Appraisal and Coping Model, the Health Belief Model, the theory of Self-Efficacy, and the Bio-psycho-social Model (9). The synthesis of these models has provided an opportunity for a more in-depth and comprehensive view of the adjustment process. In 2022 the researchers behind SCIAM suggested a simplified version that can be used for mediation analyses (16), seen in Figure 2.

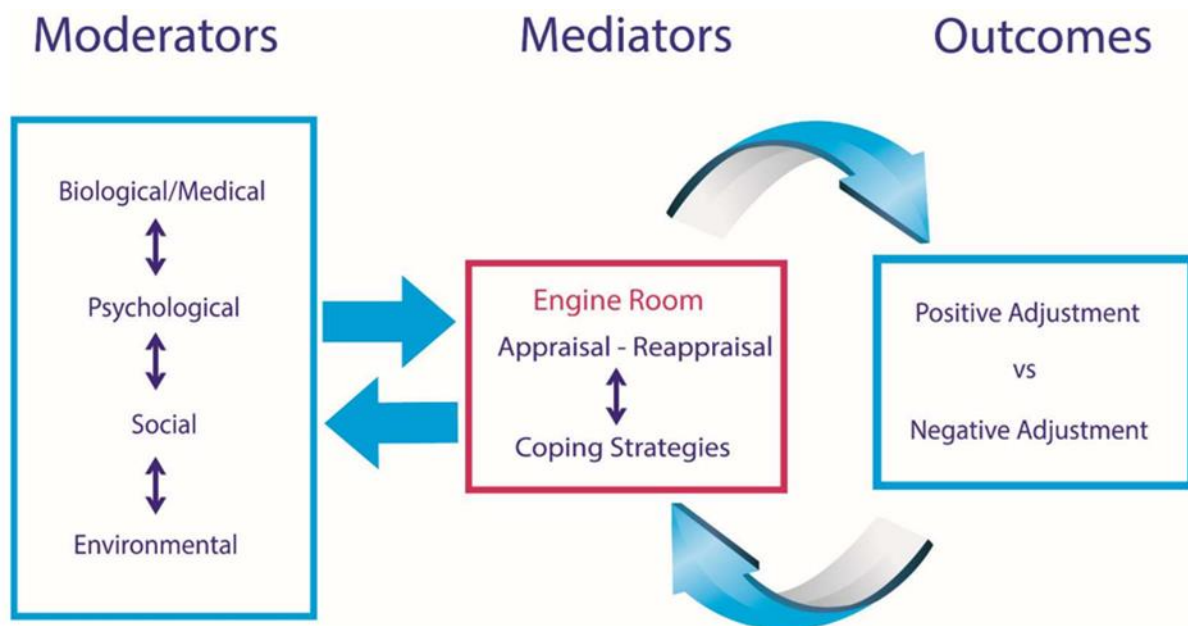


Figure 2: Updated Spinal Cord Injury Adjustment Model suggested by Craig and Tran (16) for mediation analysis. The model shows the interaction of moderators, mediators, and adjustment.

2.2.2 The dynamics of the SCIAM

The SCIAM includes both moderators and mediators. The model suggests that moderating factors influence the association between two other factors. Moderating factors can influence the association's strength or direction (20). Examples of moderating factors according to SCIAM can be age, gender, time since injury, personality, relationships, compensation, social support, and religion. Research on SCIAM has shown bio-psycho-social factors such as social support and SHCs are moderators for adjustment (9).

Mediators in SCIAM are seen as the intervening factors that explain the mechanism or the relationship between independent and dependent variables (20). Examples of mediators according to SCIAM can include self-efficacy, coping strategies, and appraisals. These mediators are believed to affect the relationship between the bio-psycho-social factors and the adjustment outcome.

In the SCIAM the researchers theorize that there is a process of appraisal, implementation of coping strategies, and re-appraisal that take place during adjustment (9, 16). SCIAM suggests that a person appraises their situation and their abilities, otherwise known as self-efficacy, and then decides on a specific set of behaviors, for example, problem-solving or avoidance. According to the researchers these behaviors are the chosen coping strategies. They theorize that if the behavior is successful and leads to positive adjustment, the behavior is likely to be maintained. If the adjustment outcome is negatively impacted, there will be a re-appraisal process which could lead to new adaptive or maladaptive coping strategies being implemented.

Craig and colleagues claim that the mediating process is fundamental to the adjustment process as this is where adaptation takes place by using appropriate coping strategies (16). SCIAM suggests that there is double mediation, as shown by the arrows in Figures 1 and 2. Namely, appraisal (self-efficacy) can influence coping and that in turn influences adjustment (9, 16).

According to the SCIAM, adjustment can include various factors (9). For example, negative adjustment outcomes can be seen in a depressive mood, anxiety, relationship breakdown, substance abuse, and social isolation. On the contrary, positive adjustment outcomes can include participating in the social environment, for example retaining employment, volunteering, or good quality of life (9).

2.2.3 Research on SCIAM

Previous research has shown that moderating and mediating factors can influence adjustment (15, 16, 17, 19). However, studies on SCIAM have focused on self-efficacy as a predisposing psychological resource (15, 17, 19). Only a few studies reported on the mediating effect of coping strategies (17, 18, 19) or self-efficacy (16). Therefore, there is a need for further investigation into the mediating effect of self-efficacy and coping strategies. Furthermore, previous studies on SCIAM only use one adjustment outcome, for example, depression (15, 17, 18, 19).

2.2.4 Strengths and limitations of using SCIAM

Strengths of SCIAM include that it is an elaborate theoretical model of the internal processes of the person, the thinking behind the actions and the chosen coping strategies. SCIAM is also specific to SCIs and has been used in previous SCI research. SCIAM incorporates the psychological appraisal process and the non-linear change over time (9). SCIAM provides an opportunity to include various bio-psycho-social factors in the model. SCIAM was chosen for this study as it emphasizes the mediating process and is used as background for mediation analysis.

One of the limitations of SCIAM is that the adjustment outcome is dichotomous (9). This does not necessarily give an accurate reflection of adjustment as suggested by other models such as Livneh's disability model or the MOHO (8, 32). To compensate for this limitation, the adjustment outcome in this study will be calculated to range from poor to excellent. Another potential disadvantage is that the model does not make a distinction between pre-injury and post-injury bio-psycho-social factors. For example, psychological factors can be either a moderator or part of the adjustment outcome.

3. Methodology

3.1 Study design

This study uses data from the Norwegian part of the International SCI Community Survey (InSCI) (33). InSCI is a cross-sectional community survey across 22 countries, comprising more than 12 500 participants (34). InSCI forms part of the Learning Health System for Spinal Cord Injury (LHS-SCI), which aims to improve the lived experience of people with SCIs (35). The data collection of InSCI Norway (InSCI-Nor) was conducted in 2017-2018.

3.2 Participants

Participants were eligible for the study if they had either traumatic or non-traumatic SCIs, were older than 18, and had completed their primary rehabilitation since the year 2000. The participants had to have permanent residency and completed the Norwegian questionnaire. Persons with congenital or other neurological disorders were excluded from the study. Informed consent was obtained, and the data was stored and shared according to the applicable privacy and confidentiality guidelines. The electronic medical records at the three SCI hospitals in Norway (Haukeland University Hospital, St. Olav University Hospital, and Sunnaas Rehabilitation Hospital) were scanned for eligibility (33). The questionnaire was sent to 1 456 people, and 610 participants responded.

3.3 Measurement

The InSCI questionnaire was compiled in English, comprising 125 questions covering the domains of personal factors, health and well-being, body functions, as well as activity and participation based on ICF guidelines and other known data collection tools (36). The questionnaire was translated into country-specific languages according to scientific guidelines used by Epstein and colleagues (37). More information on the InSCI study protocol, the compilation of the survey, and the validity of the questions used can be found in Gross-Hemmi and Post (34) and Fekete and Post (36). The questions in the InSCI-Nor survey were used to create the variables needed for the research objectives of the present study. Specifically using data on functional independence, activity and participation, coping strategies, self-efficacy, quality of life, life satisfaction, sociodemographic details, and details on lesion characteristics. Appendix A gives a comprehensive breakdown of how each variable was created from the questions in the In-SCI-Nor.

3.4 Data preparation

All variables were adapted so that a higher score indicates a better degree of independence, self-efficacy, coping, or adjustment. To achieve this, some questions had to be inverted. For example, for the question stating, "In the last 4 weeks, how much of a problem have you had carrying out the daily routine", the participant had to give a score ranging from 1 to 5, where 5 indicates an "extreme problem" and 1 indicates "no problem". As we wanted the higher score to reflect a high degree of independence, these answers were inverted so that a score of 5 would indicate "no problem" and a score of 1 would indicate an "extreme problem".

The second step was to convert each question to a scale ranging from 0 to 100 as seen in Equation 1. The symbol x refers to a score calculated for a question ranging between 0 and 100. The symbol y refers to the answer given by the participant for that specific question. The symbol $Range_{min}$ refers to the minimum possible answer to a question, while $Range_{max}$ refers to the maximum possible answer to a question.

$$x = 100 \frac{(y - Range_{min})}{(Range_{max} - Range_{min})} \quad (1)$$

For example, if the answer to question one was 3 (on a scale from 0 to 5) and the answer to the second question was 1 (on a scale from 1 to 9), the values were calculated to be 50 and 0 (out of 100) for the two questions respectively. The mean was calculated to combine different questions of a variable. In Figure 3 the conversion from a scale ranging from 1 to 4 is converted to a scale ranging from 0-100.

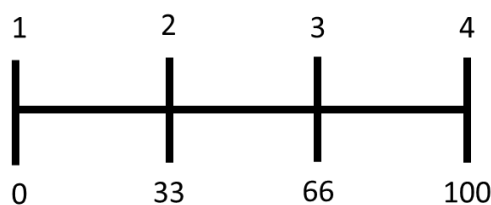


Figure 3: the conversion of a scale ranging from 1 to 4, to a scale ranging from 0-100.

If questions were not answered that specific question was not taken into consideration for that participant and the remaining questions were averaged to calculate the score for the variable. Four participants did not answer multiple questions and were removed from the dataset.

3.5 Variables

3.5.1 Confounding factors

The confounding factors included socio-demographic variables (age, gender, level of education, marital status, subjective social status, and level of income) and lesion-specific variables (level of injury, time since injury, and lesion type). The level of injury refers to paraplegic or tetraplegic. The lesion type states if it is a complete or incomplete injury.

3.5.2 Functional independence

Functional independence for this study refers to the individual's level of independence in activities of daily living, and mobility. Examples of questions included are questions on mobility, sitting, and standing. As well as self-care activities like grooming, dressing, and eating. Functional independence was chosen as the independent variable as it plays a major part in rehabilitation and is generally believed to impact adjustment post-SCI (38).

3.5.3 Mediation variables

Self-efficacy is the first of two mediating variables used in this study. As the questionnaire was completed after the SCI the self-efficacy questions refer to the participant's self-efficacy post-SCI, therefore it is viewed as a mediator and not as a pre-existing independent variable. Questions included were about the participants confidence to overcome challenges.

Coping strategies are the second mediating variable. In this study, we will focus on active coping strategies, which can be categorized under adaptive coping strategies (13). Active coping is part of problem-focused coping and refers to behavioral and cognitive actions that aim at changing the situation and thereby decreasing the negative effects of the stressful situation (22, 39). The questions included are questions on maintaining good health, taking care of yourself and others, interacting with others, and engaging in relaxational activities.

3.5.4 Adjustment

Previous studies have used depression or anxiety (16, 17, 18), participation (19), or life satisfaction (15) as outcome variables. The adjustment variable for this study was created based on previous research and taking the Norwegian context into account. The aim is to create a comprehensive variable that includes various factors that contribute to adjustment into society.

Therefore, the adjustment variable included paid work participation and recognition, social participation and recognition, quality of life, life satisfaction, vitality, and mental health.

Paid work is included as it has been shown that employment plays an important role in participation in the Norwegian context (6, 40). From previous studies on this subject, we see that mental health measures such as depression or anxiety are appropriate measures to use for an adjustment outcome (16, 17, 18). Some of the other studies also used participation, life satisfaction, or quality of life as their outcome measure for adjustment. (15, 19) and was therefore also included in our adjustment variable.

In contrast to these other studies mentioned, a continuous adjustment variable was chosen as it has been argued to be more in line with the human psychological process than a dichotomous adjustment outcome variable (8).

3.6 Analyses

IBM SPSS statistics (version 29) was used for statistical analyses. Descriptive statistics such as the mean and standard deviation were calculated for the demographic variables of the participants. All the variables were tested to determine if they were normally or non-normally distributed. The adjustment variable was normally distributed. The other variables were not normally distributed.

To account for confounding factors all the analyses included stratified bootstrapping (1000 samples) or multivariate regression analysis with the following factors: age, gender, level of education, marital status, years since injury, level of income, subjective social status, level of injury (paraplegic vs tetraplegic), and type of injury (complete vs incomplete). The statistically significant level for all analyses was set to p-value < 0,05.

Spearman correlation was used to test the correlation between the level of functional independence and adjustment. This test was chosen as the level of functional independence variable was not normally distributed, and a non-parametric test was required. A result with a positive value between 0 and 1 would indicate a positive correlation between the two factors. Indicating that as functional independence increases, then adjustment will also increase. However, a negative value between 0 and -1 would indicate a negative correlation where adjustment would decrease if functional independence increases (42).

For the second research question, an independent two-sample t-test was done to determine if there was a difference in adjustment between the two gender groups. Firstly, the adjustment variable was tested for normality for the entire sample and then tested for the male and female groups independently, all groups were normally distributed.

For the third research question, a measurement of mediation analysis was done. Firstly, the regression analysis assumptions were met: linearity, normality, homoscedasticity, and independence (20). The analysis was done with the PROCESS macro in SPSS. The model chosen was a double mediation analysis with two mediators, as illustrated in Figure 4. In SPSS various models describe different mediation analyses. Model 6 In SPSS reflects a double mediation analysis with two mediators. This analysis method was chosen based on the example of Craig and Tran (16), and the methods described in Hayes (20).

In Figure 4, the d' refers to the direct relationship between the level of functional independence and the level of adjustment in the presence of coping strategies and self-efficacy. Pathway a shows the effect that independence has on self-efficacy and pathway b shows the effect that self-efficacy has on coping strategies. Pathway c shows the effect that coping strategies have on adjustment. Pathway f depicts the effect of self-efficacy on adjustment without passing through coping strategies. Lastly, pathway e shows the effect of independence on coping strategies without first passing through self-efficacy.

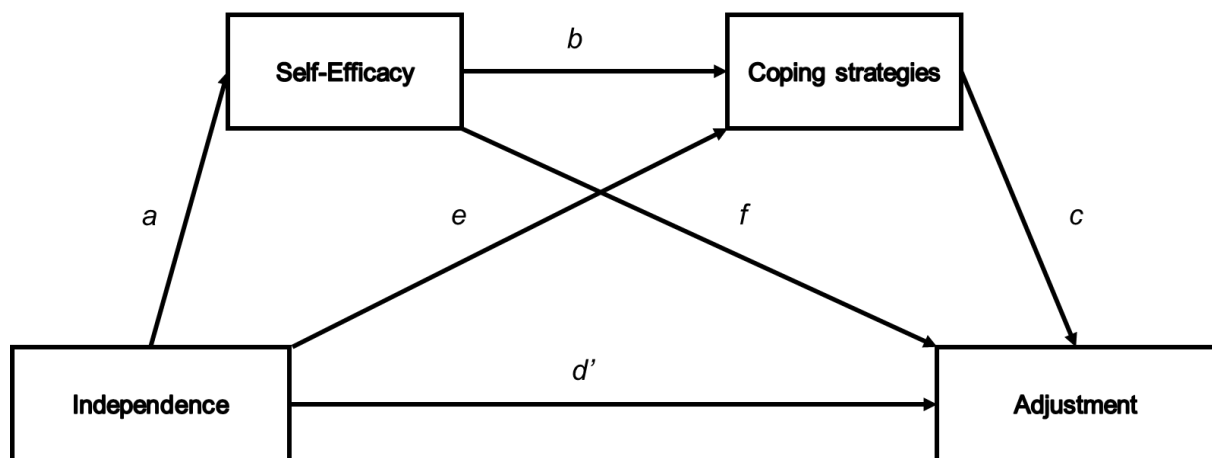


Figure 4: model used for mediation analysis. It shows the pathway between functional independence, self-efficacy, coping strategies, and adjustment. The direct effect of functional independence on adjustment is marked by pathway d' .

To visualize the effect that each mediator has on adjustment the total and indirect effects were calculated along with the mediation proportions. Mediation proportions were calculated by dividing the indirect effect of each pathway by the total effect. The mediation proportion shows how much of the relationship between functional independence and adjustment passes through a specific mediator.

3.7 Ethical considerations

The InSCI-Nor gained ethical approval from the Regional Ethical Committee (REK 2016/1184) with a supplemental application in 2017. This study forms part of this ethical approval. All appropriate privacy and confidentiality guidelines were followed during the analysis and sharing of the data.

4. Results

4.1 Participants

The average age of the participants in the study was 56,9 years. The majority of the participants were male (68,5%). The injury characteristics were paraplegic (58,5%) and tetraplegic (41,5%). The average time since injury was 9 years. See Table 1 for all the demographic data.

*Table 1: the descriptive statistics of the demographic data. The majority of the table is reported in the number of participants and percentages. *Age and Years since injury is reported in mean and standard deviation.*

Characteristic	Participants (%)
<i>Gender</i>	
Male	418 (68,5)
Female	192 (31,5)
<i>Relationship status</i>	
Single	103 (16,9)
Married	297 (48,7)
Cohabiting or partnership	38 (6,2)
Separated or divorced	70 (11,5)
Widowed	97 (15,9)
Missing values	5 (0,8)
<i>Education</i>	
Primary	42 (6,9)
Lower Secondary	51 (8,4)
Higher Secondary	137 (22,5)
Post-Secondary	102 (16,7)
Short Tertiary	90 (14,8)
Bachelor or equivalent	96 (15,7)
Master or equivalent	73 (12)
Other	11 (2)
Missing values	7 (1,1)
<i>Level of injury</i>	
Paraplegic	338 (58,5)
Tetraplegic	240 (41,5)
Missing	32
<i>Completeness of injury</i>	
Complete	106 (18)
Incomplete	482 (82)
Missing	22
<i>Age *</i>	56,9 (16,3)
<i>Years since injury *</i>	9,0 (5,11)

4.2 Variables

The mean and standard deviation of the converted variables are described in Table 2 for dependent, independent, and mediation variables.

Table 2: the mean and standard deviation of the converted score of the independent, dependent, and mediation variables. The score ranges from 0-100, where 0 is the worst score and 100 is the best possible score.

Variables	Mean (Standard deviation)
Level of Functional Independence	73,97 (24,29)
Level of Self-efficacy	66,92 (19,55)
Level of Active Coping	74,87 (21,28)
Level of Adjustment	57,12 (14,97)

4.3 Research objective one: correlation

The results showed a statistically significant positive correlation between the level of functional independence and adjustment with an r-value of 0,436 (95% CI: 0,43 to 0,44; p-value <0,001). This value was calculated with all the confounding factors considered together, but without considering any mediating factors.

4.4 Research objective two: gender differences

The second result is that of the independent two-sample t-test. This test showed a statistically significant difference in the level of adjustment between males and females (p-value=0,036). The mean difference between the groups was estimated to be 2,90 (95% CI: 0,19 to 5,61). The mean adjustment among males was calculated to be 58 out of 100, with a standard deviation of 15,27. Among females, the mean adjustment was 56 out of 100, with a standard deviation of 13,45.

4.5 Research objective three: mediation analysis

The third goal of this study was to assess the double mediating role of self-efficacy and active coping strategies on the relationship between functional independence and adjustment. The sample size for the mediation analysis was 572 due to missing values that were eliminated.

Table 3 elaborates on the results with the confidence intervals (CI) of each result. It is important to note that there is a statistically significant correlation between self-efficacy and coping strategies. Furthermore, the direct effect between independence and adjustment is not statistically significant. The results in Figure 5 show the coefficient results for each pathway with all covariates considered simultaneously.

Table 3: the regression coefficients with related confidence intervals for each pathway in the model. IND refers to functional independence. SE is self-efficacy. CS refers to coping strategies. ADJ is the level of adjustment.

Pathway	Coefficient	Confidence intervals
IND > SE (a)	0,21	0,14 - 0,29
SE > CS (b)	0,36	0,31 - 0,47
CS > ADJ (c)	0,26	0,21 - 0,31
IND > ADJ (d')	0.01	-0.02 - 0.06
IND > CS (e)	0,34	0,27 - 0,42
SE > ADJ (f)	0,26	0.21 - 0,31

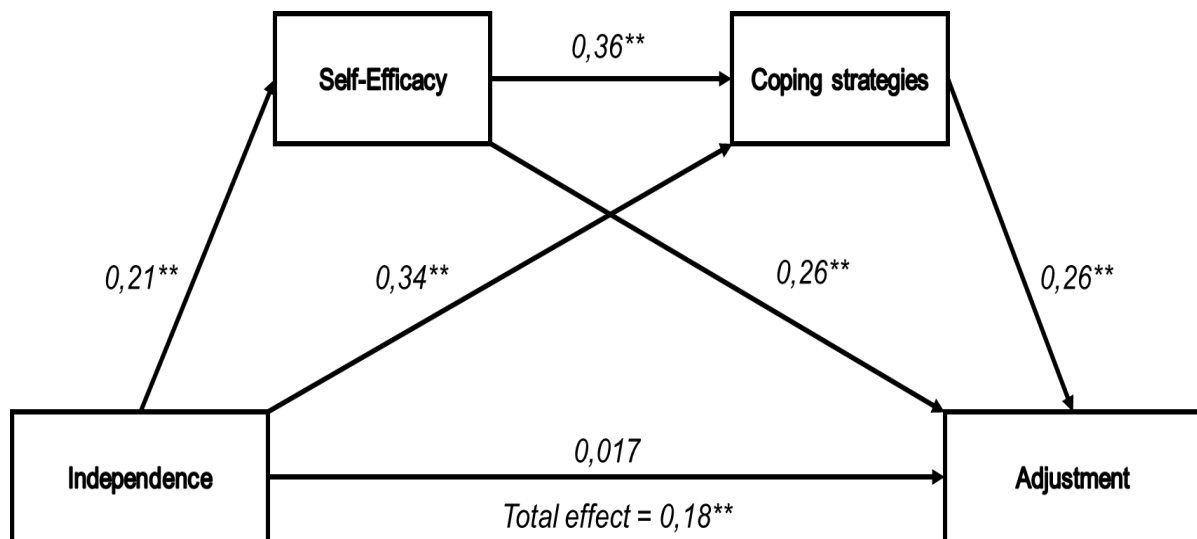


Figure 5: Mediation path model for the relationship between the level of functional independence and level of adjustment mediated by self-efficacy and level of active coping strategies used. Regression coefficients are depicted next to the pathway. P-values <0,001 are marked with **.

Table 4 depicts the effect of each of the pathways and the resulting mediation proportion which can be used to measure the size of the impact of the mediating factors.

Table 4: summary of the total, direct, and indirect effects of functional independence on adjustment. The coefficient and related confidence intervals are reported. Mediation proportions are also provided. IND refers to functional independence. SE is self-efficacy. CS refers to coping strategies. ADJ is the level of adjustment.

Effect	Coefficient	Confidence intervals	Mediation proportion
Direct	0,01	-0,02 - 0,06	0,09
Indirect: IND > SE > ADJ	0,06	0,03 - 0,08	0,30
Indirect: IND > CS > ADJ	0,09	0,06 - 0,12	0,49
Indirect: IND > SE > CS > ADJ	0,02	0,01 - 0,03	0,12
Total effect	0.18	0.13 - 0.24	-

When adding one covariate at a time, we saw that the biggest change was that the direct effect between independence and adjustment changed to be between 0,04 and 0,05 with the confidence intervals not crossing 0, therefore, a statistically significant pathway. However, with the level of income also added as a covariate the direct effect changed to 0,03 with the confidence intervals crossing 0, making the direct pathway not statistically significant anymore.

In summary, firstly the results showed a statistically significant positive correlation between the level of functional independence and the level of adjustment. Secondly, we found a statistically significant difference in the level of adjustment between males and females. Thirdly, the findings showed self-efficacy and the use of active coping strategies act as mediating factors in the relationship between the level of functional independence and the level of adjustment.

5. Discussion

The study examined the relationship between functional independence and level of adjustment. The first hypothesis was supported by the result showing that there is a positive correlation between functional independence and adjustment. The second hypothesis of a significant difference in adjustment between males and females was also supported. Lastly, the third hypothesis was supported by the results showing that self-efficacy and active coping strategies act as mediators in this relationship. Our results supported the theorized framework of the SCIAM and found a double mediating effect.

5.1 Research objective one: correlation

The results showed a significant positive correlation between functional independence and adjustment. This result is in line with previous research arguing that higher levels of functional independence and mobility are associated with higher QOL and life satisfaction (38, 41). The r-value of 0,44 found in this study can be interpreted as a weak to moderately strong correlation between functional independence and adjustment (42). It is also in line with earlier studies where functional independence only explains a small amount of variance (38, 41). The results are in line with SCIAM (9, 16), and similar theoretical models that suggest that functional independence can influence adjustment (8, 21, 32).

This result shows that there is a direct correlation between functional independence and adjustment. However, this correlation is without considering any mediating factors. The third result of this study aims to explain the relationship between these factors in the presence of self-efficacy and active coping strategies.

5.2 Research objective two: gender differences

Females have somewhat lower adjustment levels than males, but the difference was small, and not necessarily clinically significant. Although this result could not be compared to previous research, some aspects might explain the difference in adjustment between males and females. The adjustment outcome included mental health and vitality symptoms and it has previously been reported that females have higher levels of depression and anxiety compared to males with SCIs (11, 27), which would in our study correlate with lower adjustment outcomes. Another explanation for the difference in adjustment can be due to the difference in coping strategies used. Previous studies suggested females tend to use more emotion-focused coping instead of active problem-focused coping (26).

As seen in the results active coping strategies can be beneficial to adjustment. If females then do not use active coping strategies as often as males, this might explain the differences in adjustment levels between the genders.

This difference might also be due to the selection of questions that are included in the adjustment variable. If another set of questions were chosen for the dependent variable the result might potentially differ. The adjustment level was measured with the same variables for both males and females. It can be argued that the societal roles might differ according to gender.

Therefore, if variables that reflect the societal roles a person is aspiring to are included in adjustment it might give a more accurate representation of adjustment. For example, one person might not be interested in finding paid work and would rather focus on being a homemaker. In such a case, including paid work in the adjustment variable would not give an accurate representation of their adjustment after injury. This shows the need for qualitative research in conjunction with quantitative research on adjustment as it is a complex concept.

Even though the difference in adjustment is small, it does show that there is a difference between the gender groups, and this is something that can be improved upon. As the adjustment variable included mental health and vitality, work, social integration, QOL, and life satisfaction, all these areas could be addressed during rehabilitation and in the transition to community living to improve adjustment for the population living with SCIs.

5.3 Research objective three: mediation

From the results, we see that the direct correlation between functional independence and level of adjustment disappears once we consider alternative pathways through self-efficacy and active coping strategies. This means that self-efficacy and coping strategies have a significant influence on adjustment levels.

For example, if we consider a patient with low functional independence, their adjustment will also be low. However, if we improve the patient's self-efficacy and teach them active coping strategies it might improve their adjustment, despite them still having low functional independence. Therefore, self-efficacy and active coping strategies can be effective in negating the negative effects of loss of functional independence and is therefore an important factor to consider in the rehabilitation process. This finding supports the use of cognitive behavioral therapy and other programs specifically tailored to teach patients how to cope and adapt after an SCI (43).

5.3.1 Double mediation

The pathway between self-efficacy and active coping strategies was statistically significant. This shows us that there is a double mediating effect between self-efficacy and coping strategies. Therefore, how a person evaluates themselves and their abilities does impact whether they use active coping strategies. This result supports the double mediation effects suggested in the SCIAM (9).

Several studies that used structural equation modelling did not support the SCIAM theoretical concept of double mediation (15, 17, 19). However, Craig and Tran used a measure of mediation analysis and similar data as our study and they reported double mediation (16).

5.3.2 Self-efficacy as a mediator

The findings show that self-efficacy is a mediator in the pathway between functional independence and adjustment. This is similar to what Craig and Tran (16) reported. Other studies on SCIAM have used self-efficacy as a moderating factor or as a predisposing psychological resource and their results cannot be compared to this study (15, 19). It can be argued that self-efficacy is part of secondary appraisal, where a person evaluates their abilities to overcome a stressful situation. The results of self-efficacy being a mediator supports the SCIAM model that appraisals influence coping which in turn influences adjustment. Self-efficacy as the only mediator was not the pathway with the strongest mediation proportion, but it is still valuable to include in treatment protocols to improve adjustment.

5.3.3 Active coping strategies as a mediator

The strong mediating effect of active coping strategies supports previous research that has reported that adaptive coping strategies can improve participation, life satisfaction, depressive and anxiety symptoms, and other psychological outcomes (13, 23, 25). Furthermore, this finding is in line with other studies that reported coping strategies as a mediator in the adjustment process (15, 17, 18, 19).

The difference in the stronger mediating effect found in this study might be explained by the fact that coping was measured on a scale ranging from maladaptive to adaptive and not in categories. The larger mediating effect could also be due to the use of a more comprehensive model of adjustment in this work.

As mentioned, the coping variable was mainly focused on active coping strategies. However, the opposite of most of the active coping strategies can be considered as avoidance coping strategies.

In this study, a low coping score could correlate with avoidance coping. Therefore, the results of this study support previous research that avoidance coping is negatively associated with adjustment (15, 18)

5.3.4 Impact of the level of income

It is important to note that the level of income changed the direct pathway between the level of functional independence and adjustment to become statistically insignificant. This means that if we take the level of income into account then there is no direct pathway between functional independence and adjustment. This supports previous findings that suggested higher income can lead to increased participation and QOL (6). If we interpret this through the SCIAM it might be explained by the theorized effect of social and environmental factors on adjustment such as a person's financial status.

If a person has a higher income it could lead to better healthcare and assistive devices, however in the Norwegian context there is substantial welfare assistance for citizens, including appropriate assistive devices (44). Another explanation might be that level of income influences other areas of life, for example, a person with higher income might have less anxiety and better mental health or life satisfaction.

5.4 Cultural context

This study was done on the Norwegian population with SCIs. The factors included in the adjustment outcome were specifically chosen to depict the important factors of Norwegian society. Therefore, aspects regarding work, social responsibility, and connectedness were included in the adjustment variable along with more commonly known factors such as mental health and quality of life (6, 40). If we consider how these added variables influence adjustment, we see that it confirms the theorized ideas of SCIAM that depict adjustment as a complex concept that is influenced by cultural values. This also supports previous studies (15, 17, 19) that found similar results to the results of this study that were done in different cultural backgrounds and other Western European countries.

Researchers can adapt their adjustment variables to reflect the culture or country they are studying. Furthermore, coping strategies can also be influenced by cultural and other societal contexts. How coping is defined and what type of coping is generally accepted in society can influence which type of coping strategies a person implements. Therefore, clinicians can incorporate the demands and influences of culture in their evaluation and treatment of an individual when using SCIAM as a theoretical model.

5.5 Limitations and future work

This study is based on a cross-sectional survey of participants in the community, with an average of 9 years since the injury. Therefore, the results of this study cannot directly be applied to the acute setting. Although previous research on SCIAM included acute and community-dwelling patients (15, 17, 19) and found similar results. More research needs to be done in the acute setting and with longitudinal study designs to generalize the results of this study.

Another limitation of this study is that it only included self-efficacy and coping strategies and no other psychological resources such as primary appraisals. The use of primary appraisal as a mediator was not possible in this analysis due to the absence of relevant questions in the questionnaire.

This present study did include a wide variety of confounding factors such as demographics, education, income, and lesion characteristics. This provides a certain measure of generalizability to the results. However, there are more confounding factors that might influence the results. For example, the economic, political, cultural, and healthcare environment will be different in different countries and therefore the results are not directly comparable. Secondary health conditions should also be considered as a confounding factor to functional independence and adjustment in future studies. Furthermore, the concept of self-efficacy and coping is complex and combined study designs of qualitative and quantitative research might yield the best understanding of coping and adjustment in the population with SCIs.

Suggestions for future work in this area could also look at the flexibility and combination of different coping strategies instead of the categorization of coping strategies. The use of a continuous adjustment variable in this study did provide some flexibility, but the results of this study can be improved upon by combining other coping strategies on a continuous scale. Different coping strategies might have different mediating effects and research into this can guide us in which strategies to focus on during rehabilitation.

6. Implications and Conclusion

The main implication of this study is the importance of including active coping strategies and improved self-efficacy in the rehabilitation of patients that sustained an SCI. It is also a reminder of the importance of adapting treatment protocols to the needs of everyone, specifically considering their gender and culture as this might influence their adjustment.

Our findings support the use of coping-orientated support programs as they have also shown significant results in mental health and life satisfaction outcomes (43). Further research into similar programs is necessary to improve patient care.

From this study, we see that the SCIAM is an effective model to use in the adjustment of patients with an SCI. Furthermore, this study contributed to the current knowledge on SCIAM by supporting the mediating effect of self-efficacy and coping. The study did not add new depth to the theoretical model, but it did highlight the effect that gender and societal context can have on adjustment.

The level of functional independence influences the adjustment of a person with an SCI. However, active coping strategies and self-efficacy fully mediate the relationship between functional independence and adjustment. Females also tend to have a slightly lower level of adjustment, and care must be taken that treatment is adjusted according to gender. This study has added to the base of knowledge that mediating psychological resources such as self-efficacy and coping strategies are important factors to consider in the rehabilitation process of a person with an SCI.

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Appendices

Appendix A: Tables describing the compilation of the variables.

The tables below show the questions used from the InSCI-Nor questionnaire to create the variables for functional independence, self-efficacy, active coping strategies, and level of adjustment. Each table shows the category the questions were taken from, the question, and the answers the participants could choose from.

Table 1: Questions used from the InSCI-Nor questionnaire to form the coping strategies variable.

Category	Question statement	Response Options
Coping strategies	In the last 4 weeks, how much of a problem have you had...	
	... looking after your health, eating well, exercising, or taking your medicine?	Score 1 (no problem) to 5 (extreme problem)
	...getting your household tasks done?	Score 1 (no problem) to 5 (extreme problem)
	...taking care of others?	Score 1 (no problem) to 5 (extreme problem)
	...Interacting with people?	Score 1 (no problem) to 5 (extreme problem)
	...doing things for relaxation?	Score 1 (no problem) to 5 (extreme problem)

Table 2: Questions used from the InSCI-Nor questionnaire to form the self-efficacy variable.

Category	Question statement	Response Options
Personal factors	How confident are you that you can find the means and ways to get what you want if someone opposes you?	Score 1 (not at all) to 5 (completely)
	How confident are you that you could deal efficiently with unexpected events?	Score 1 (not at all) to 5 (completely)
	How confident are you that you can maintain contact with people who are important to you?	Score 1 (not at all) to 5 (completely)
	How confident are you that you can maintain good health?	Score 1 (not at all) to 5 (completely)

Table 3: Questions that were used from the InSCI-Nor questionnaire to create the functional independence variable.

Category	Question statement	Response Options
Assistance	Do you get assistance with your day-to-day activities at home or outside?	Yes or No
Activity and Participation	In the last 4 weeks, how much of a problem have you had carrying out your daily routine?	Score 1 (no problem) to 5 (extreme problem)
	In the last 4 weeks, how much of a problem have you had getting where you want to go?	Score 1 (no problem) to 5 (extreme problem)
	Are you able to sit unsupported?	Yes or No
	How much of a problem is sitting for long periods such as 30 minutes?	Score 1 (no problem) to 5 (extreme problem)
	Are you able to stand?	Yes or No
	How much of a problem is standing for long periods such as 30 minutes?	Score 1 (no problem) to 5 (extreme problem)
Independence in activities of daily living	Eating and drinking	Range from independent to total assistance
	Washing your upper body	Range from independent to total assistance
	Washing your lower body	Range from independent to total assistance
	Dressing your upper body	Range from independent to total assistance
	Dressing your lower body	Range from independent to total assistance
	Grooming	Range from independent to total assistance
	Using a toilet	Range from independent to total assistance
	Transfer from the bed to the wheelchair	Range from independent to total assistance
	Moving around moderate distances (10 to 100 meters)	Nine possible responses ranged from total assistance with a wheelchair to walking moderate distances without walking aids.

Table 4: Questions from the InSCI-Nor questionnaire used to form the level of adjustment variable.

Category	Question statement	Response Options
Vitality	Did you feel full of life?	Score 1 (all of the time) to 5 (none of the time)
	Did you have a lot of energy?	Score 1 (all of the time) to 5 (none of the time)
Mental health	Have you felt calm and peaceful?	Score 1 (all of the time) to 5 (none of the time)
	Have you been happy?	Score 1 (all of the time) to 5 (none of the time)
Work	Are you currently engaged in paid work?	Yes or No
	I receive the recognition I deserve for my work.	Score 1 (strongly agree) to 4 (strongly disagree)
Social recognition	Do you feel included when you are with other people?	Score 1 (not at all) to 5 (completely)
	I feel connected to people in my immediate environment.	Score 1 (strongly agree) to 5 (strongly disagree)
Life satisfaction and quality of life	How would you rate your quality of life?	Score 1 (very dissatisfied) to 5 (very satisfied)
	How satisfied are you with your life?	Score 1 (very dissatisfied) to 5 (very satisfied)
	How satisfied are you with your ability to perform your daily living activities?	Score 1 (very dissatisfied) to 5 (very satisfied)
	How satisfied are you with yourself?	Score 1 (very dissatisfied) to 5 (very satisfied)
	How satisfied are you with your personal relationships?	Score 1 (very dissatisfied) to 5 (very satisfied)
	How satisfied are you with your living conditions?	Score 1 (very dissatisfied) to 5 (very satisfied)



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